

Update

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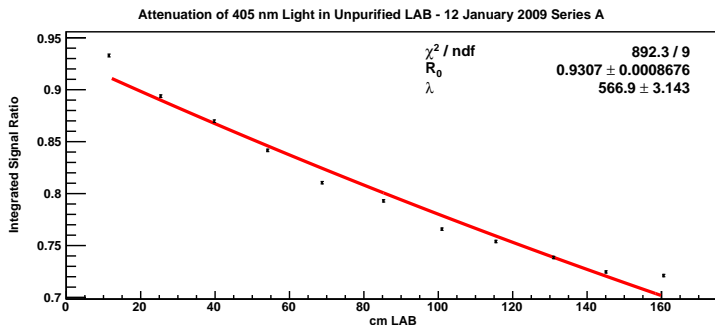
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Overview

1 Attenuation Measurements

2 Blind Analysis

measurements since the dual LED upgrade have showed the proper trend, but strong deviations from an exponential light loss



The PMT was drawing 2x the anode current as previous runs. Was the tube broken?

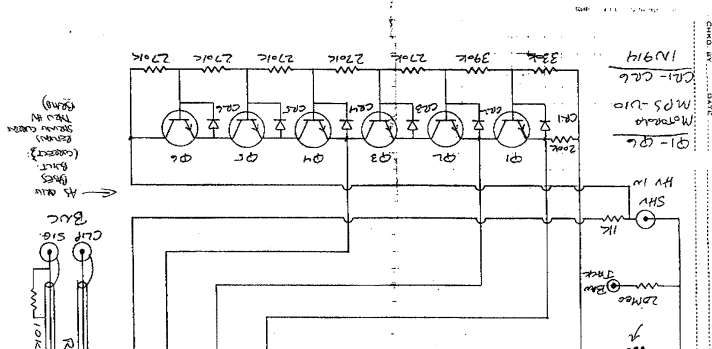
- PMT response was analyzed for linearity in pulse integrated charge and amplitude $\rho = 0.6$ which was lower than expected, but acceptable
- Pulse shape universality was characterized by looking at the distribution of charge moments in time. Distributions were nearly identical

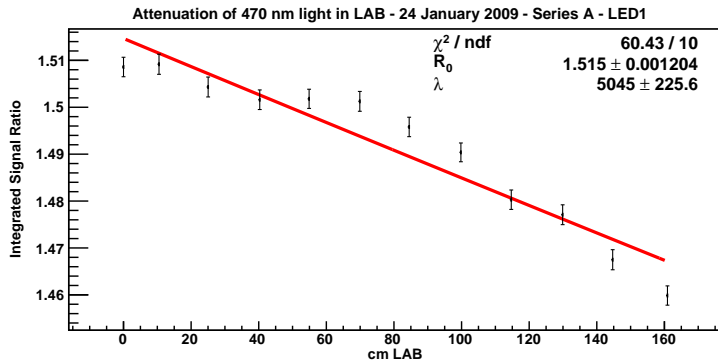
Tube response was fine for our purposes, even though it was odd.

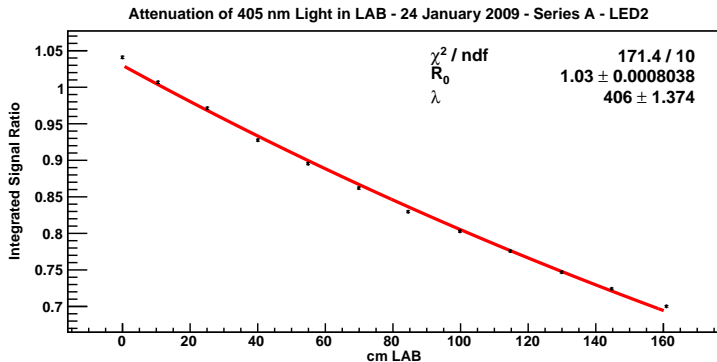
Strategy was to try and get the system as close to previously successful measurements as possible.

- Return to single LED system - 470 nm (have the most measurements at this wavelength)
- Change out phototube or base if necessary to return to 1 mA anode current

- Stole four more bases from 949 tested anode current with LED beam system (same PMT): 1.092 mA, 1.098 mA, 1.096 mA, **1.095 mA**
- A transistor or two probably died in the old tube

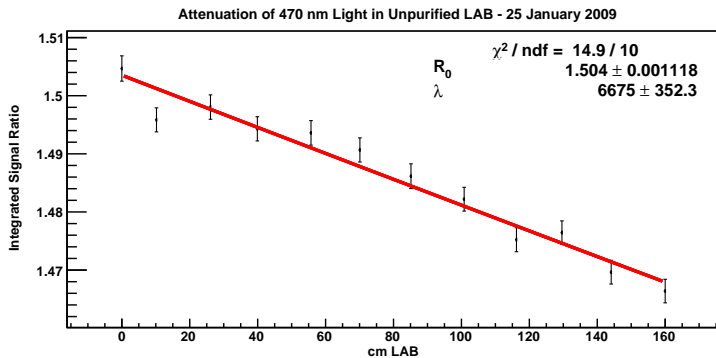


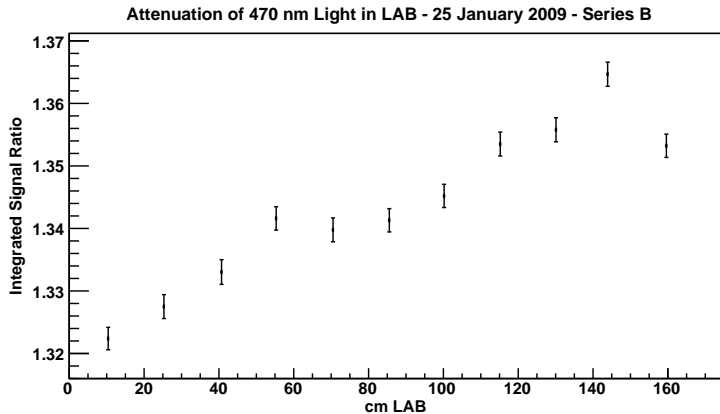




- Dual LED measurements are still off with new base
- Perhaps we're blasting the PMT with too much light too often.... Perhaps we should keep the same pulse rate with the dual system as the single... that means 'ping-ponging' the trigger.

... but first let's see what we get with a single LED ...





Okay... so what is so different about these two runs?

- Series A was taken as the sample column was **filled**.
- Series B was taken as the sample column was **drained**.

The beam was aligned before each run. The movement of the beam spot is imperceptible by eye, but perhaps not with the PMT. The size of the effect at 470 nm may be artificial!

- This demonstrates the usefulness of the dual LED system, because we can divide out the mechanical effect evident from the barely attenuated 470 nm light.
- A global fit can be made between the two wavelengths with some assumptions about the beam profile. This is a work in progress.

We can constrain this model with the difference between Series A and B with the fact:

- Series A was taken as the sample column was **filled**.
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The beam was aligned before each run. The movement of the beam spot is imperceptible by eye, but perhaps not with the PMT. The size of the effect at 470 nm may be artificial!

Start sketching analysis schemes for θ_{13}

- Precision measurement \rightarrow We want as much information as possible to understand backgrounds and systematics, while shielding us from tuning the 'answer '
- leave the energy spectrum alone
- we don't have a signal 'box '
- blinding the site is impractical...because it will be obvious
- splitting the data set is impractical, because we need a lot of statistics to understand the backgrounds... and the more events the better to precisely measure θ_{13}

okay... so two humble suggestions for a 'blinding' strategy...

We know that reactor power will fluctuate on the order of a few percent over the life cycle of the fuel ...

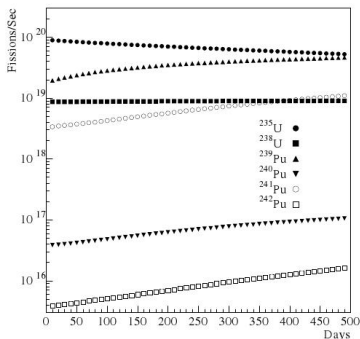


FIG. 1: Fission rates for various isotopes during a typical 500 day fuel cycle for one of the Palo Verde Nuclear Generating Station reactors in Arizona (USA). >99.9% of the $\bar{\nu}_e$ s are emitted by ^{235}U , ^{238}U , ^{239}Pu , and ^{241}Pu [16].

from isotopic composition (above) and power, but power really dominates

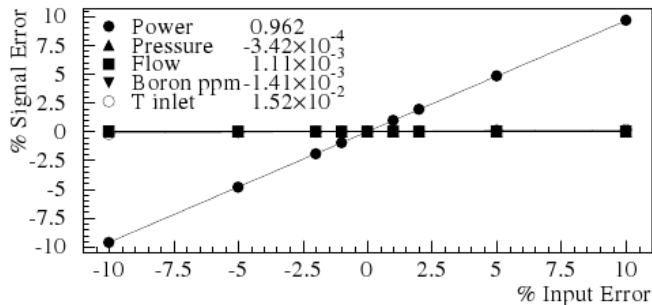


Figure: Djurcic et. al. (2008)

The idea is to apply a randomized time shift in **FAR SITE** events consistent with the characteristic power variation of **fractions of a percent** to prevent fits better than a few percent; to be removed before the final analysis at the end of the experiment. I am working on quantifying this with a toy model from the above paper. With it we can produce a dual sensitivity curve that tracks the blinded procedure against an 'open 'analysis strategy to evaluate whether it's worth it.

For the competitive, this has a nice advantage for nailing Chooz but maintaining a blind procedure: If the signal is so large that it overwhelms the few percent blind after a year or two, we can unblind early.

- May or may not compound this strategy with a fit to a parameter that is from θ_{13} ex. instead of terms like $\sin^2(2\theta_{13})$ use $\sin^2(f(\epsilon)2\theta_{13})$ where ϵ is some random parameter removed before the final analysis.
- The first strategy can be enforced by the offline group.
- The second cannot.